Oct. 12, 1948. H. P. HELLER 2,451,338

ELECTRICAL CONDENSER

Filed Nov. 11, 1944

Fig. 1.

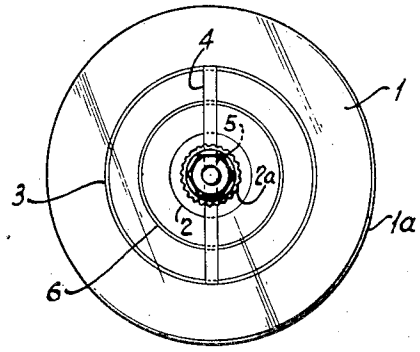


Fig. 2.

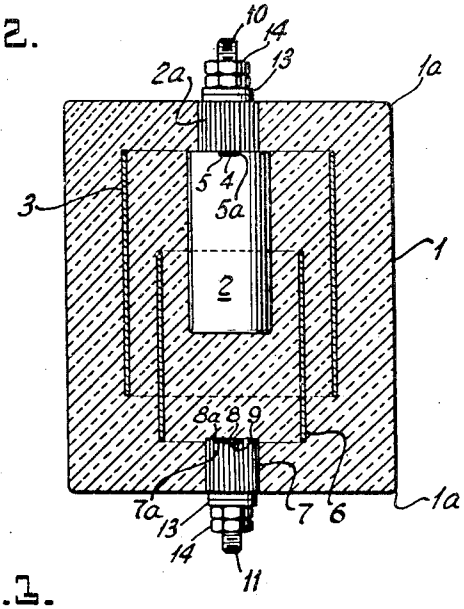
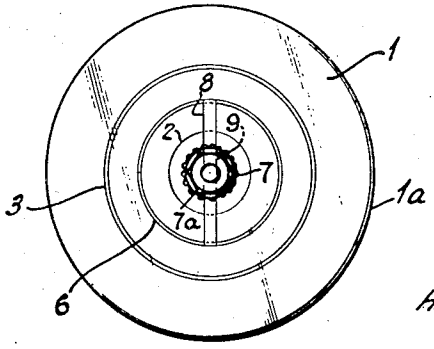


Fig. 3.



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ELECTRICAL CONDENSER

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6 Claims. (Cl. 175—41)

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This invention relates to a new and useful high voltage condenser, and is particularly directed to improvements in electrical condensers having concentric electrodes which are surrounded by a solid dielectric.

An object of this invention is to simplify and improve electric condensers of a high voltage type.

Another object of this invention is to provide an improved molded condenser of the solid dielectric type wherein the objectionable shrinkage cracks and voids which develop in the cooling of the solid dielectric are substantially eliminated.

A feature of this invention is the novel and improved method of supporting the electrodes so that only a minimum amount of small shrinkage cracks and voids can form in the molded embedment.

This invention is an improvement in molded condensers of the solid dielectric type as disclosed in the United States patent application of Gurdon H. Williams, Serial No. 515,897, filed December 28, 1943.

It is desirable to employ polystyrene as a solid dielectric for high voltage condensers such as employed in the circuit of an electron microscope; however, it has been found that there is a slight disadvantage in that undesirable voids frequently develop which lead to the formation of corona discharge and a subsequent breakdown of the condenser, particularly when condensers of this type are used in circuits having voltage in the order of 20 to 30 kilovolts. I have found that, in order to cast a concentric type molded capacitor without the formation of such undesirable internal voids which are due to the unrelieved shrinkage of the solid embedment, it will be necessary to use a minimum amount of mechanical support for the electrodes. According to my invention a narrow strip or rod like member is secured to each terminal member and is located in a plane which is normal to the walls of the cylindrical electrodes for supporting them. Such a construction provides substantially free ends for each electrode so that the shrinkage of the embedment upon cooling from its casting temperature will be wholly relieved, which will obviate formation of undesirable voids that have been found to lead to corona discharge and subsequent breakdown of the condenser.

This invention will best be understood by referring to the accompanying drawing in which:

Fig. 1 is a top plan view of the condenser of this invention;

Fig. 2 is a cross-sectional of Fig. 1; and

Fig. 3 is a bottom plan view of Figs. 1 and 2.

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Referring now in detail to the drawing, the condenser includes a relatively heavy block 1 of polystyrene or any suitable insulating material having the necessary electrical insulating qualities. The outside surfaces of the polystyrene embedment are machine and/or fire polished and finished with rounded corners 1A. A central right circular solid cylindrical electrode 2 is combined with the terminal of the condenser which is provided with a shoulder and optionally knurled portion 2A. The central electrode 2 also supports an outer electrode 3, in the form of a hollow open ended right circular cylinder. The electrode 3 is concentrically supported at its base from the central electrode 2 by a narrow metallic strip 4 which is preferably that of a circular or rectilinear cross sectional member which passes through an aperture 5 in member 2. The strip 4 is arranged to support electrode 3 in a plane normal to walls of both electrodes 2 and 3. Located in a position intermediate between electrodes 2 and 3 is a third electrode 6 which is spaced equidistant between the metallic surfaces of the adjacent electrodes to provide a minimum voltage breakdown desistance in the order of 30 kilovolts. A terminal stud 7 is secured to electrode 6 at its base by a narrow strip metallic member 8 which is fastened in a slot 9 at the end of terminal 7 by means such as soldering and brazing. Terminal 7 is knurled at 7A in a manner similar to that of the knurled portion 2A of electrode 2 to provide additional locking action by the dielectric. The strip 8 supports electrode 6 by being secured to a slot located at its end which passes through the base center of the electrode, and can be stamped with the electrode as an integral part. The base ends of each open cylinder are rounded off to prevent the formation of corona discharge. A threaded stud 10 is provided integrally in the upper portion of member 2, and a similar stud 11 is provided in member 7 for making electrical connection to the condenser electrodes by the use of washers 13 and nuts 14. After the condenser is assembled and adjusted for capacity, monomeric styrene with or without peroxide type catalyst (such as 1 hydroxy-cyclohexyl hydroperoxide-1 or partially polymerized styrene) is poured into a mold which is sufficient to completely cover the condenser structure and provide a finished condenser with a wall thickness which is substantially twice as large as the spacing of the intermediate electrode 2, in a manner similar to that described in the above mentioned Williams patent application. The mold is then placed in an oven with a temperature of approxi-

mately 135° C. for a period up to 72 hours. The entire condenser structure is taken from the oven. The mold removed from the polymerized condenser block, and the molded block is then placed in a lathe or other suitable machine and turned to the desired outline of the finished condenser as shown in Fig. 2. A final fire-polishing operation will complete the processing by giving the surface exceptional smoothness and clarity.

While I have described a condenser of my invention it will be apparent to one skilled in the art that the invention is by no means limited to the particular device shown and described but that many modifications may be made without departing from the scope of my invention.

What is claimed:

1. An electric condenser of the high voltage type comprising a right circular solid cylinder center electrode, one end of which forms a terminal of said condenser, an outside electrode and an intermediate electrode both of which are hollow open ended right circular cylinders, another terminal for said condenser, said outside electrode being supported by a strip member to said center electrode on a line which passes through one of the base centers of said outside electrode, said intermediate electrode being supported by a strip member passing through one of its base centers and electrically connected to said last mentioned terminal member, and an embedment of polystyrene completely surrounding said electrodes.

2. An electric condenser comprising a central electrode, an outer electrode and an intermediate electrode both of which are hollow open ended right circular cylinders, external end terminal members each having a strip support for electrically connecting and supporting said electrodes at one of the base centers of each cylinder to provide a support in the horizontal plane which is narrow relative to the diameters of said electrodes to permit the casting of a solid dielectric without the formation of internal voids due to unrelieved shrinkage.

3. An electric condenser having a plastic dielectric embedment comprising two hollow open ended right circular cylindrical metallic electrodes, an end terminal for each electrode having a slot therein, support means passing through the slot of each terminal member to support each one of said electrodes at one of its open ends so as to be in capacitive relationship with respect to each other to permit the plastic dielectric embedment between and around said electrodes to serve as a solid dielectric without the formation of internal voids due to unrelieved shrinkage of the plastic dielectric embedment.

4. An electric condenser having a polystyrene embedment comprising two hollow open ended right circular cylindrical metallic electrodes, an end terminal for each electrode having a knurled portion and a slot therein, support means passing through a slot of each terminal member to support said electrodes at one of its open ends to be in capacitive relationship with respect to each other to permit the polystyrene embedment between and around the knurled portion of the terminal members to provide a locking action to retain the terminals to the polystyrene embedment, and around said electrodes to serve as a solid dielectric without the formation of internal voids due to unrelieved shrinkage of the polystyrene.

5. An electric condenser of the high voltage type, comprising a plurality of hollow open ended metallic members all of which are capacitively arranged with respect to each other to form some of the condenser electrodes, a terminal member located at each end of said condenser, one of said terminal members extending within the hollow open ended members to be in capacitive relationship therewith and having means passing therethrough to support at least one of said hollow open ended members at one of its open ends, the other terminal member having means located at one of its ends for supporting another one of said hollow open ended metallic members at its open ends, and a solid moldable dielectric entirely surrounding all of said electrodes and a portion of each one of said terminal members.

6. An electric condenser of the high voltage type, comprising a plurality of hollow open ended metallic members all of which are capacitively arranged with respect to each other to form some of the condenser electrodes, a solid terminal member having a knurled and a threaded portion centrally located at each end of said condenser, one of said terminal members extending within the hollow open ended members to be in capacitive relationship therewith and having means passing therethrough to support at least one of said hollow open ended members at one of its open ends, the other terminal member having means located at one of its ends for supporting another one of said hollow open ended metallic members at its open ends, and a solid moldable dielectric entirely surrounding all of said electrodes and the knurled portion of each one of said terminal members.

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